I claim:

1. A method for enhancing communications in a wireless electromagnetic communications network (WECN) having a set of nodes, comprising:

forming a communications link between any subset of nodes in said WECN;

modifying an intentional signal to be transmitted along said communications link by embedding at a transmitting node an invariant structure therein;

converting said modified intentional signal into analog electromagnetic waves;

transmitting said analog electromagnetic waves to at least one authorized and intended receiving node;

detecting said analog electromagnetic waves at said receiving node;

converting said analog electromagnetic waves into said modified intentional signal at said receiving node;

differentiating said modified intentional signal from environmental noise through said embedded invariant structure at said authorized and intended receiving node;

recovering said intentional signal by de-embedding said invariant structure; and,

repeating until all of the intentional signal has been modified, sent, detected, differentiated, and recovered along said communications link.

2. A method as in Claim 1, further comprising:

using an adaptation algorithm to enable the WECN to dynamically adjust transmissions to account for experienced environmental effects.

3. A method as in Claim 1, wherein embedding at a transmitting node an invariant structure therein, and recovering said intentional signal by de-embedding said invariant structure, further comprises:

using a time-slot embedding approach.

4. A method as in Claim 1, wherein embedding at a transmitting node an invariant structure therein, and recovering said intentional signal by de-embedding said invariant structure, further comprises:

using a delay-invariant embedding approach.

5. A method as in Claim 1, wherein embedding at a transmitting node an invariant structure therein, and recovering said intentional signal by de-embedding said invariant structure, further comprises:

using a frequency-invariant embedding approach.

6. A method as in Claim 1, wherein embedding at a transmitting node an invariant structure therein, and recovering said intentional signal by de-embedding said invariant structure, further comprises:

using any combination of a time-slot embedding, delay-invariant embedding, or frequency-invariant approach.

7. A method as in Claim 2, wherein the step of using an adaptation algorithm to enable the WECN to dynamically adjust transmissions to account for experienced environmental effects further comprises:

using any adaptation algorithm that exploits the high correlation between the embedded and unimbedded signal segments to differentiate between intentional and unintentional signals.

8. A method as in Claim 7, wherein the step of using any adaptation algorithm that exploits the high correlation between the embedded and unimbedded signal segments to differentiate between intentional and unintentional signals further comprises:

using an Auto-SCORE approach.

9. A method as in Claim 7, wherein the step of using any adaptation algorithm that exploits the high correlation between the embedded and unimbedded signal segments to differentiate between intentional and unintentional signals further comprises:

using a Dominant-Mode-Prediction (DMP) approach.

10. A method as in Claim 7, wherein the step of using any adaptation algorithm that exploits the high correlation between the embedded and unimbedded signal segments to differentiate between intentional and unintentional signals further comprises:

determining whether an Auto-SCORE, DMP, or combination approach best meets the current environmental constraints and goals of the WECN for that communications link; and,

using that approach.

11. A method as in Claim 1, wherein the step of embedding at a transmitting node an invariant structure therein further comprises:

using an embedded-key generation means to create, for said communications link, a uniquely identifiable embedding structure.

12. A method as in Claim 11, wherein the step of using an embedded-key generation means to create, for said communications link, a uniquely identifiable embedding structure, further comprises:

using an environmental condition external to said WECN and detectible at each of the transmitting and receiving nodes, in the origination of said embedded key.

13. A method as in Claim 12, wherein said environmental condition external to said WECN further comprises:

a Global Positioning Satellite, Universal Time Coordinates (GPS-UTC) signal.

14. A method as in Claim 1, further comprising:

exploiting the ability of MIMO internode responses, and the ability to detect and differentiate packets prior to fine synchronization between receiving and transmitting nodes of the WECN, to use previous network-based structural synchronization to a predetermined standard.

15. A method as in Claim 1, further comprising:

exploiting the ability of MIMO internode responses, and the ability to detect, differentiate, and recover packets prior to fine synchronization between receiving and transmitting nodes of the WECN, to use previous network-based structural synchronization to a standard external to the WECN.

16. A method as in Claim 14, wherein said ability to detect, differentiate, and recover packets prior to fine synchronization further comprises:

employing directive or retrodirective multielement diversity distribution weights, derived from receive weights, over subsequent transmission intervals, to guide detection, differentiation, and recovery of packets.

15. A method as in Claim 15, further comprising:

using said directive or retrodirective multielement diversity distribution weights to permit the source transceivers to direct energy away from jamming emitters, and towards intended receive nodes, thereby providing an additional degree of jam resistance, by allowing reception at increased SINR at the other end of the link.

16. A method as in Claim 3, wherein using a time-slot embedding approach further comprises:

gathering source data generated at an intermediate modulation stage into $N_{\mathrm{slot}}\times 1$ vectors of data elements, each such vector being denotable by $\mathbf{d}_{\mathrm{TX}}(n)$;

transmitting said data elements in a series of sequential timeslots $\{\mathbf{d}_{\mathrm{Tx}}(n\text{-}1), \mathbf{d}_{\mathrm{Tx}}(n), \mathbf{d}_{\mathrm{Tx}}(n+1)\}$;

generating an embedded structure;

combining said $\mathbf{d}_{\mathrm{TX}}(n)$ and embedded structure in a slot multiplexer by a reversible structural embedding process known to the intended receiver of $\mathbf{d}_{\mathrm{Tx}}(n)$; and passing $\mathbf{d}_{\mathrm{Tx}}(n)$ onto subsequent modulation operations necessary to generate the RF transmitted signal waveform.

17. A method as in Claim 16, wherein the step of generating an embedded structure further comprises:

using a key-generation algorithm for each slot's source data element $\mathbf{d}_{Tx}(n)$ based on an element that is known at both ends of the communications link.

18. A method as in Claim 17, wherein said element that is known at both ends of the communications link is a Time-of-Day (TOD) in GPS Universal Time Coordinates (GPS-UTC).

19. A method for enhancing communications in a wireless electromagnetic communications network (WECN) having a set of nodes, comprising:

forming one or more communications links between a first node and at least a second node and a third node, within a subset of nodes in said WECN;

modifying an intentional signal to be transmitted along said communications link by embedding at a transmitting node an invariant structure therein;

converting said modified intentional signal into analog electromagnetic waves;

transmitting said analog electromagnetic waves to at least one authorized and intended receiving node;

detecting said analog electromagnetic waves at said receiving node;

converting said analog electromagnetic waves into said modified intentional signal at said receiving node;

differentiating said modified intentional signal from environmental noise through said embedded invariant structure at said authorized and intended receiving node;

recovering said intentional signal by de-embedding said invariant structure;

and,

repeating until all of the intentional signal has been modified, sent, detected, differentiated, and recovered along said communications link.

20. A method for enhancing communications in a wireless electromagnetic communications network (WECN) having a set of nodes, comprising:

forming a communications link between any subset of nodes in said WECN;

modifying an intentional signal to be transmitted along said communications link by embedding it, at a transmitting node, into an invariant structure;

converting said modified intentional signal into analog electromagnetic waves;

transmitting said analog electromagnetic waves to at least one authorized and intended receiving node;

detecting said analog electromagnetic waves at said receiving node;

converting said analog electromagnetic waves into said modified intentional signal at said receiving node;

differentiating, at said authorized and intended receiving node, said modified intentional signal from environmental noise through said invariant structure into which it was embedded;

recovering said intentional signal by de-embedding said invariant structure; and,

repeating until all of the intentional signal has been modified, sent, detected, differentiated, and recovered along said communications link.

21. A method as in Claim 20, wherein the step of modifying an intentional signal to be transmitted along said communications link by embedding it, at a transmitting node, into an invariant structure, further comprises any embedding operation that projects said intentional signal onto linear subspace known at both ends of said communications link.

22. A method as in Claim 20, wherein the step of modifying an intentional signal to be transmitted along said communications link by embedding it, at a transmitting node, into an invariant structure, further comprises any embedding operation that projects said intentional signal onto linear subspace estimable at both ends of said communications link.

23. A method as in Claim 20, wherein the step of modifying an intentional signal to be transmitted along said communications link by embedding it, at a transmitting node, into an invariant structure, further comprises any embedding operation that allows said

intentional signal to be decomposed into highly correlated segments after known processing operations feasible at the receiving node.

24. A method as in Claim 1, for nodes where the communications link may have significantly changed between a first and second communication events, further comprising:

using fine synchronization that compensates for observed timing and carrier offset between said first and second communication events along said link, to complete demodulation and decoding of the transmitted intentional signal after said intentional signal has been detected, differentiated, and extracted from the noise and interference encountered by the receiving node.

25. An apparatus for enhancing communications in a wireless electromagnetic communications network (WECN) , comprising:

a set of transceiving nodes, each node further comprising:

a transmitter of electromagnetic waves;

a receiver of electromagnetic waves;

means for analogue-to-digital, and digital-to-analog, conversion of electromagnetic waves to and from an intentional, orginal digital signal, respectively;

means for embedding into said intentional, orginal digital signal an invariant structure;

means for differentiating a received, intentional, orginal digital signal by detecting the presence or absence in the same of said invariant structure; and,

means for recovering from a received digital signal both said invariant structure and said intentional, orginal digital signal.

26. A method as in Claim 1, wherein embedding at a transmitting node an invariant structure therein, and recovering said intentional signal by de-embedding said invariant structure, further comprises:

using a tone-multiplexing embedding approach.

27. A method as in Claim 11, wherein the step of using an embedded-key generation means to create, for said communications link, a uniquely identifiable embedding structure, further comprises generating a multi-link embedding key using information concerning one or more of the transmitting node, intended receipient node or nodes, and WECN or sub-group channel organization.

28. A method as in Claim 27, further comprising:

using said multi-link embedding key at the receiving node, by passing a received possible signal through a multitone demodulater and then a demultiplexer;

separating said received possible signal into its component x_0 and x_1 elements, the latter having the embedded structure;

modifying the x_1 element by removing therefrom the p_0 (network) and p_2 (recipient node) subkeys;

examining the correlation between the modified x_1 element and the x_0 element; and,

upon finding sufficient correlation, passing the modified x_1 element and x_0 element through as an intended signal to the multilink diversity combiner (211) to produce the signal data $\mathbf{d}_{Rx}(k,n)$.